

What is claimed is:

1. A method of making hollow, reinforced plastic composite articles, comprising the steps of:

3 a) providing:

4 i) a hollow preform of reinforcing fibers intimately intermixed  
5 with a thermoplastic material, said preform having a cylindrical sidewall  
6 portion, a domed bottom portion, and a domed top portion, and

7 ii) a rigid mold having a cylindrical sidewall portion and domed  
8 end portions corresponding to said preform portions;

9 b) positioning said preform against the inner surface of said  
10 corresponding mold portions;

11 c) compressing said preform with an internally pressurized, inflatable  
12 core having a cylindrical sidewall portion, and top and bottom dome portions to hold  
13 said preform in place;

14 d) heating said preform to a temperature sufficient to melt said  
15 thermoplastic material while the pressure in said inflatable core compresses said  
16 preform and maintains the distribution of the thermoplastic material throughout said  
17 preform to provide a fiber reinforced molded article;

18 e) cooling said molded article until said thermoplastic material is  
19 substantially solid;

20 f) reducing the pressure in said inflatable core; and

21 g) removing said molded article from said mold.

1 2. The method of claim 1 wherein the pressure in said inflatable core is  
2 increased during the heating step to compress said preforms and maintain the  
3 distribution of thermoplastic material throughout said preform, whereby voids in the  
4 fiber reinforced molded article may be further reduced.

1 3. The method of claim 1 wherein said hollow preform comprises a  
2 separately preformed sidewall portion and integrated bottom portion and a separately  
3 preformed top dome portion.

1       4. The method of claim 1 wherein said hollow preform comprises a  
2 separately preformed cylindrical sidewall portion and comprises separately preformed  
3 domed portions.

1       5. The method of claim 4 wherein the separately preformed cylindrical  
2 sidewall portion is a filament wound sidewall portion and the separately preformed  
3 domed portions are filament wound geodesic domed portions.

1       6. The method of claim 5 wherein the sidewall portions overlap the  
2 domed portions.

1       7. The method of claim 4 wherein said cylindrical sidewall portion is  
2 formed from a rectangular blanket of said reinforcing fibers intimately intermixed  
3 with said thermoplastic material, said blanket being positioned against said cylindrical  
4 sidewall portion of the mold with a slight overlap of opposite ends of said blanket.

1       8. The method of claim 1 wherein the ratio of reinforcing fiber to  
2 thermoplastic material is substantially constant throughout said preform.

1       9. The method of claim 8 wherein said ratio is approximately 3:2.

1       10. The method of claim 1 wherein the ratio of glass fiber to thermoplastic  
2 material varies within said preform.

1       11. The method of claim 1 wherein the wall thickness of said preform is  
2 substantially constant.

1       12. The method of claim 1 wherein the wall thickness of said preform  
2 varies along its length.

1       13. The method of claim 1 wherein said reinforcing fibers are glass fibers.

1           14.    The method of claim 13 wherein said glass fibers are approximately 1  
2    inch in length.

1           15.    The method of claim 1 wherein said thermoplastic material is chosen  
2    from the group comprised of: polypropylene, polyethylene, polybutylene  
3    terephthalate, polyethylene terephthalate, and nylon.

1           16.    The method of claim 1 further comprising, prior to said compressing,  
2    the step of treating the outer surface of said inflatable core with an adhesive agent so  
3    that said core is bonded to the interior of said molded article.

1           17.    The method of claim 1 further comprising, prior to said compressing,  
2    the steps of:

3           treating a surface of one of the top and bottom dome portions and an adjacent  
4    sidewall portion of said inflatable core with an adhesive agent to provide an adhesive  
5    coated portion; and

6           treating a surface of another of said top and bottom dome portions and an  
7    adjacent sidewall portion with a releasing agent to provide a release coated portion;  
8    and, after said removing, the step of:

9           disengaging the release coated portion of said inflatable core from an inner  
10   surface of said molded article while the adhesive coated portion remains adhered to an  
11   inner surface of said molded article.

1           18.    The method of claim 1 further comprising, prior to said compressing,  
2    the step of treating the outer surface of said inflatable core with a releasing agent; and,  
3    after removing said molded article from the mold, the step of removing said inflatable  
4    core from said molded article.

1           19.    The method of claim 1 wherein said temperature is approximately 400  
2    °F and maintaining said temperature for a period of at least approximately 30 minutes.

1           20. The method of claim 2 wherein said pressure is increased to  
2 approximately 2530 psi.

1           21. The method of claim 1 wherein said thermoplastic material is in  
2 fibrous form.

1           22. The method of claim 19 wherein said fibrous form is approximately 2  
2 inch lengths of thermoplastic material.

1           23. The method of claim 1 wherein said thermoplastic material is provided  
2 in particulate form.

1           24. The method of claim 1 wherein said inflatable core is a neoprene  
2 bladder.

1           25. The method of claim 1 further comprising the step of connecting said  
2 mold to a source of vacuum during the heating step to further reduce the incidence of  
3 voids in the finished article.

1           26. The method of claim 2 further comprising the step of connecting said  
2 mold to a source of vacuum during the heating step to further reduce the incidence of  
3 voids in the finished article.

1           27. A method of making hollow, reinforced plastic composite articles,  
2 comprising the steps of:

3           a) providing:

4           i) a hollow preform comprised of reinforcing fibers intimately  
5           intermixed with a thermoplastic material, said preform having a cylindrical  
6           sidewall portion, a domed bottom portion, and a domed top portion;  
7           ii) a hollow plastic liner within said preform, said liner having a  
8           cylindrical sidewall portion, a domed bottom portion, and a domed top  
9           portion; and

12                   b)     positioning said preform against the inner surface of said  
13     corresponding mold portions;

14 c) heating said preform sufficient to melt said thermoplastic material and  
15 distribute the thermoplastic material throughout said preform to provide a fiber  
16 reinforced molded article;

17 d) cooling said molded article until said thermoplastic material is  
18 substantially solid; and

19 e) removing said molded article from said mold.

1                   28.     The method of claim 27 wherein said plastic liner is a thermoplastic  
2     liner.

1           29. The method of claim 27 further comprising, during said heating, the  
2 step of pressurizing the plastic liner with a gas or a fluid; and prior to removing said  
3 molded article from the mold, the step of reducing the pressure in said plastic liner.

1           30. The method of claim 29 further comprising, during said heating, the  
2 step of connecting said mold to a source of vacuum during the pressurizing step to  
3 further reduce the incidence of voids in the finished article.

31. A method of making hollow, reinforced plastic composite articles, comprising the steps of:

3 a) providing:

11                   b)     positioning said preform against the inner surface of said  
12     corresponding mold portions;

13                   c)     compressing said preform with an internally pressurized, flexible  
14     inflatable core having a cylindrical sidewall portion, and top and bottom dome  
15     portions to hold said preform in place;

16                   d)     heating said preform to approximately 400 degrees F while  
17     maintaining that temperature for between 20 and 60 minutes, while also increasing the  
18     pressure in said inflatable core to approximately 25-30 psi to compress said preform  
19     and maintain the distribution of the thermoplastic material throughout said preform to  
20     provide a substantially void free fiber reinforced molded article;

21                   f)     cooling said molded article until said thermoplastic material is  
22     substantially solid;

23                   g)     reducing the pressure in said inflatable core;

24                   h)     removing said molded article from said mold; and

25                   i)     removing said inflatable core from the molded article.

1                 32.    The method of claim 29 further comprising the step of connecting said  
2     mold to a source of vacuum during said heating to further reduce the incidence of  
3     voids in the finished article.

1                 33.    A method of making hollow, reinforced plastic composite articles,  
2     comprising the steps of:

3                   a)     providing:  
4                     i)     a hollow preform of glass reinforcing fibers intermixed with  
5     thermoplastic material, said preform having a filament wound cylindrical  
6     sidewall portion, a filament wound domed bottom portion, and a filament  
7     wound domed top portion, wherein said cylindrical sidewall portion overlaps  
8     each geodesic domed portion; and  
9                     ii)    a rigid mold having a cylindrical sidewall portion and domed  
10    end portions corresponding to said preform portions;  
11                   b)     positioning said preform against the inner surface of said  
12    corresponding mold portions;

13           c) compressing said preform with an internally pressurized, flexible  
14   inflatable core having a cylindrical sidewall portion, and top and bottom dome  
15   portions to hold said preform in place;

16           d) heating said preform to approximately 400 degrees F while  
17   maintaining that temperature for between 20 and 60 minutes, while also increasing the  
18   pressure in said inflatable core to approximately 25-30 psi to compress said preform  
19   and maintain the distribution of the thermoplastic material throughout said preform to  
20   provide a substantially void free fiber reinforced molded article;

21           f) cooling said molded article until said thermoplastic material is  
22   substantially solid;

23           g) reducing the pressure in said inflatable core;

24           h) removing said molded article from said mold; and

25           i) removing said inflatable core from the molded article.

1           32 The method of claim 31 further comprising the step of connecting said  
2   mold to a source of vacuum during said heating to further reduce the incidence of  
3   voids in the finished article.